Staff Report

USE INFORMATION AND AIR MONITORING RECOMMENDATIONS FOR THE PESTICIDE ACTIVE INGREDIENTS ACEPHATE, CHLOROTHALONIL, AND METHAMIDOPHOS

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USE INFORMATION AND AIR MONITORING RECOMMENDATION FOR AGRICULTURAL APPLICATIONS OF THE PESTICIDE ACTIVE INGREDIENTS ACEPHATE, CHLOROTHALONIL, AND METHAMIDOPHOS

A. BACKGROUND

This recommendation contains general information regarding the physical-chemical properties and the historical uses of acephate, chlorothalonil, and methamidophos. The Department of Pesticide Regulation (DPR) provides this information to assist the Air Resources Board (ARB) in their selection of appropriate locations for conducting pesticide air monitoring operations.

Acephate

Table 1 describes some of the physical-chemical properties of acephate and figure 1 depicts its chemical structure.

Table 1 Some Physical-Chemical Properties of Acephate[1]

Chemical name	O,S-dimethyl acetylphosphoramidothioate
Common name	Acephate
Some tradenames[†]	Address, Orthene
CAS number	30560-19-1
Molecular formula	$C_4H_{10}NO_3PS$
Molecular weight	183.16
Form	Colorless crystals with a strong, mercaptan-like odor (US EPA, 2001)
Solubility	8.18×10^5 ppm at 25 °C
Vapor pressure	2.66×10^{-7} mmHg at 25 °C
Soil adsorption Coefficient (K_{oc})	= 2.73
Aerobic soil metabolism half-life	0.5 – 13 days
Anaerobic soil metabolism half-life	5.2 – 6.4 days

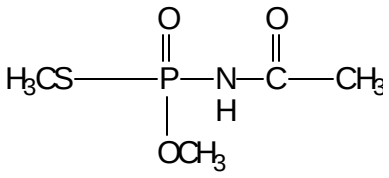
[1]Data from DPR, 2001a

Acephate is an organophosphate insecticide with residual systemic activity of about 10-15 days at recommended use rates (EXTOXNET, 2001). Soil metabolism is a significant degradation process. Acephate dissipates rapidly with half-lives of 0.5-13 days in aerobic soils and 5.2-6.4 days in anaerobic soils. The main degradation product is methamidophos,

[†]Disclaimer: The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such products.

which is itself an insecticidally active compound with final degradation products of carbon dioxide and microbial biomass (see section on methamidophos).
Acephate is soluble and moderately adsorptive. Therefore, it is considered to be mobile in most soils. It is reported that acephate is hydrolytically and photolytically stable in pH 5 and pH 7 waters with the hydrolysis half-lives of 169 to 325 days and aqueous photolysis half-lives of 17.5 to 173 days (DPR, 2001a). Based on the vapor pressure and solubility of acephate, it is not expected to volatize from either soil or water in significant amounts.

Figure 1 The Chemical Structure of Acephate



Acephate

Acephate has a LC_{50} (96 hours) of >1,000 mg/L for rainbow trout and 2,050 mg/L for bluegill sunfish, and an oral and contact LD_{50} (90 hours) of 1.2 µg/bee (Tomlin, 1994).

Chlorothalonil

Table 2 describes some of the physical-chemical properties of chlorothalonil and figure 2 depicts its chemical structure.

Table 2 Some Physical-Chemical Properties of Chlorothalonil[1]

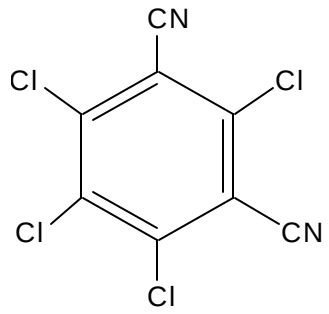
Chemical name	2,4,5,6-tetrachloroisophthalonitrile
Common name	Chlorothalonil
Some tradenames	Bravo, Echo, Daconil
CAS number	1897-45-6
Molecular formula	$C_8Cl_4N_2$
Molecular weight	265.92
Form	Grayish to colorless crystalline solid that is odorless to slightly pungent (EXTOXNET, 2001).
Solubility	1.2 ppm at 25 °C
Vapor pressure	2.0×10^{-6} mmHg at 25 °C
Soil adsorption Coefficient (K_d)	3.0 – 30.9
Aerobic soil metabolism half-life	18.3 - 154 days
Anaerobic soil metabolism half-life	5.9 – 9.3 days

[1]Data from DPR, 2001a.

Chlorothalonil is a broad-spectrum organochlorine fungicide. It is considered to be moderately persistent in soil under aerobic conditions with half-lives from 1 to 3 months. Increase in soil moisture or temperature increases degradation rates (EXTOXNET, 2001). Chlorothalonil is persistent in water when microbial activity is limited and hydrologic residence times are long. Aerobic aquatic half-lives from two hours to eight days were reported, but two-hour half-life was associated with experimental treatment other than natural systems (US EPA, 1999). Chlorothalonil is resistant to hydrolysis, photolysis, and volatilization. Half-lives for aqueous photolysis and hydrolysis are 64.7 and 49 days, respectively, at pH 5 and pH 7 (DPR, 2001a). Chlorothalonil has low mobility in silty loam and silty clay loam soils, and moderate mobility in sand. It may reach surface water via spray drift, runoff, or erosion (US EPA, 1999).

The major metabolite of chlorothalonil in soil under aerobic conditions is 4-hydroxy-2,5,6-trichloroisophthalonitrile (SDS-3701) (Tomlin, 1997). SDS-3701 is more persistent and mobile than chlorothalonil. Therefore, SDS-3701 may be available for runoff for long periods of time and persistent in water/sediment systems (US EPA, 1999).

Figure 2 The Chemical Structure of Chlorothalonil



Chlorothalonil

Chlorothalonil and its metabolites are considered highly toxic to fish with LC_{50} (96 hour) of 49 ppb for rainbow trout and 62 ppb for bluegill sunfish. It is relatively nontoxic to bees when used as recommended (Tomlin, 1997).

Methamidophos

Table 3 describes some of the physical-chemical properties of methamidophos and figure 3 depicts its chemical structure.

Table 3 Some Physical-Chemical Properties of Methamidophos[1]

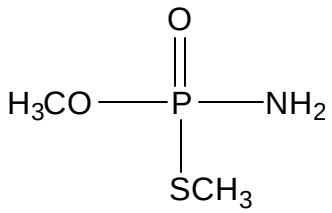
Chemical name	O,S-Dimethyl phosphoramidothioate
Common name	Methamidophos
Some tradenames	Monitor, Nitofol, Swipe
CAS number	10265-92-6
Molecular formula	$C_2H_8NO_2PS$
Molecular weight	141.13
Form	Colorless crystals with a mercaptan-like odor
Solubility	1.2×10^6 ppm at 20 °C
Vapor pressure	3.53×10^{-5} mmHg at 25 °C
Soil adsorption Coefficient (K_d)	2.9×10^{-2}
Aerobic soil metabolism half-life	0.583 day

[1]Data from DPR, 2001a.

Methamidophos is a highly active, systemic organophosphate, which acts by decreasing the activity of acetylcholinesterase in insects and mammals. Aerobic soil metabolism is the main degradation process, in which the intermediate degradate of O-desmethyl methamidophos is produced. Further degradation produces carbon dioxide and microbial biomass with a half-live of less than 5 days (US EPA, 1998b).

Methamidophos is highly soluble and poorly adsorbed onto soils; therefore, it has potential to be highly mobile. In water, methamidophos is subject to both photolysis and hydrolysis with degradates of O-desmethyl methamidophos, O,S-dimethyl phosphorothioate, and dimethylsulfide (US EPA, 1998b). The hydrolysis is very pH dependent with increasing hydrolysis rates as water alkalinity increases. Methamidophos volatilization from soil or water is not a major dissipation pathway due to its high solubility and leaching into groundwater is not expected because of its rapid degradation in aerobic environments.

Figure 3 The Chemical Structure Methamidophos



Methamidophos

Methamidophos is toxic to fish with an LC_{50} (96 hour) of 40 mg/L for rainbow trout and 100 mg/L for goldfish. It is toxic to bees whose foraging activity is severely reduced for prolonged periods after methamidophos application (EXTOXNET, 2001; Tomlin, 1997).

B. CHEMICAL USES

Acephate

Acephate is a broad-spectrum, non-fumigant, system, and contact organophosphate insecticide. It is primarily registered to control a variety of plant and soil insects in agricultural field crops. There is also substantial homeowner and food-handling establishment applications (US EPA, 1998a). Acephate is used for wide range control of biting and sucking insects, e.g. aphids, thrips, lepidopterous larvae, sawflies, leaf miners, leafhoppers, cutworms, etc. in fruit, vines, hops, olives, cotton, soy beans, peanuts, beet, beans, potatoes, rice, ornamentals, and forestry.

As of December 2001, fifty-nine products containing acephate were registered for both home-garden use and agricultural use in California. California growers use acephate largely on lettuce, cotton, dried beans, celery, and succulent beans. Acephate label recommended use rates range from 0.1 to 1 pound active ingredient (AI) per acre depending on crop type and pest to be controlled. Insect pests are generally controlled more effectively through ingestion than by contact.

Acephate is available as a soluble powder, pellet/tablet, emulsifiable concentrate, or a pressurized liquid. The product label offers various application methods, including foliar application by ground or air spray, sprinkler irrigation for cranberry, and in-furrow for cotton. The label provides further directions for application timing and resistance management. Acephate may be tank mixed with certain pyrethroids and other organophosphate insecticides as identified by the label for use on cotton. The Signal Word "Caution" is included on the label.

Chlorothalonil

Chlorothalonil is a broad spectrum, non-systemic pesticide and used primarily as a fungicide and mildewicide. It is also used as a bactericide, microbiocide, algaecide, insecticide, and acaricide (US EPA, 1999). Chlorothalonil is used to control fungi on vegetables, trees, small fruits, turf, ornamentals, and other agricultural crops, including potatoes, soy beans, peppers, strawberries, cotton, and bananas. It also is used to control fruit rot in cranberry bogs (EXTOXNET, 2001).

As of December 2001, forty-nine products containing chlorothalonil were registered for both home-garden use and agricultural use in California. California growers primarily use chlorothalonil on tomatoes, potatoes, onion, celery, carrots, and garlic. Chlorothalonil label recommended use rates range from 0.6 to 5 pounds active ingredient (AI) per acre depending on crop type and pest to be controlled.

Chlorothalonil is available as a dust, powder, granular, flowable concentrate, suspension, ready-to-use liquid, and wettable powder. The product label offers various application methods, including foliar application by ground or air spray, chemigation, and turf drench. Application through sprinkler irrigation is not recommended unless specific instructions are given for a crop on the label. The label provides further directions for application timing and season specifics and detailed spray drift precautions. The label for Bravo Ultrex® states that the product may not be used on greenhouse grown crops and is not to be combined in the spray tank with pesticides, surfactants, or fertilizers unless prior use has proven compatible and effective. The label contains Signal Word "Danger".

Methamidophos

Methamidophos is a very active, systemic, residual insecticide, acaricide, or avicide with contact and stomach action. It is used to control chewing and sucking insects, e.g. aphids, thrips, Colorado potato beetle, cabbage looper, leafhoppers, potato tuberworm and spider mites on potatoes, cotton, and tomatoes.

As of December 2001, two products containing methamidophos were registered for agricultural use in California primarily on cotton, alfalfa, tomatoes, and potatoes. Methamidophos label recommended use rates range from 0.1 to 1 pounds active ingredient (AI) per acre depending on crop type and pest to be controlled.

Methamidophos is available as an emulsifiable concentrate. The product label offers application methods, including foliar application by ground or air spray and chemigation by sprinkler irrigation to potatoes. The label designates product in 25 to 125 gallons of water per acre for ground application and 3 to 10 gallons of water for air application. The label provides further directions for use in a 7 to 10 day preventative program and detailed spray drift precautions. Methamidophos is a restricted use pesticide due to its acute dermal toxicity and residue effects on avian species and the Signal Word "Danger" is on the label.

Pesticide Use Summary

With DPR's implementation of full pesticide use reporting in 1990, all users must report the agricultural use of any pesticide to their county agricultural commissioner, who subsequently forwards this information to DPR. DPR compiles and publishes the use information in the annual Pesticide Use Report (PUR). Because of California's broad definition for agricultural use, DPR includes data from pesticide applications to cropland, parks, golf courses, cemeteries, rangeland, pastures, and rights-of-way, post-harvest applications of pesticides to agricultural commodities, all pesticides used in poultry and fish production, and some livestock applications in the PUR. DPR does not collect use information for home and garden uses, or most industrial and institutional uses. The information included in this monitoring recommendation reflects widespread cropland

applications of the three chemicals, acephate, chlorothalonil, and methamidophos. Use rates were calculated by dividing the total pounds of each chemical used (where the chemical was applied to acreage) by the total number of acres treated.

According to the PUR, the annual cropland use sum of these three chemicals in California from 1997 to 2000 ranged approximately 900,000 to 1,700,000 pounds. The majority of use occurred in six counties- Fresno, Kern, Monterey, Ventura, Kings, and Imperial. The annual use of the three chemicals in the top 15 counties accounted for 84%, in average, of the total use in California (Table 4). Tables 5, 6, and 7 display monthly use of acephate, chlorothalonil, and methamidophos, respectively, in each county for the years 1997-2000. As summarized in Table 8, acephate and methamidophos applications mostly occur in July and August and chlorothalonil is largely used in June through September. In California, acephate is primarily used on lettuce, cotton, beans, and celery (Table 9). Chlorothalonil is generally applied on processing/canning tomatoes, potatoes, onions, and celery (Table 10). Methamidophos use is predominantly on cotton, alfalfa and processing/canning tomatoes (Table 11).

Use of these chemicals is difficult to predict as disease, fungal or insect pressure is somewhat dependent on weather and other factors, such as cultural practices, even supply/demand on crop market. However, if no drastic changes in weather occur, use pattern is, in general, not expected to change significantly.

Table 4 Annual Use of Acephate, Chlorothonil, and Methamidophos by County
(Pounds of Active Ingredient)

County	1997	1998	1999	2000	Four-Year Total
FRESNO	208,514.87	427,556.33	227,228.43	236,176.50	1,099,476.13
KERN	166,279.76	310,515.51	113,083.36	122,721.59	712,600.23
MONTEREY	122,714.89	119,984.71	115,918.78	100,932.52	459,550.90
VENTURA	103,029.09	106,222.83	71,280.67	73,088.15	353,620.73
KINGS	102,422.94	89,489.39	54,574.54	35,952.50	282,439.36
IMPERIAL	93,854.45	64,682.00	55,608.57	50,195.54	264,340.56
SAN JOAQUIN	66,781.38	61,480.54	55,646.69	45,278.87	229,187.49
MERCED	36,761.59	49,255.24	52,190.25	52,896.30	191,103.38
YOLO	51,498.28	66,495.79	43,750.08	21,009.83	182,753.99
STANISLAUS	42,066.61	55,525.87	44,370.41	31,778.99	173,741.88
SAN DIEGO	52,538.45	55,793.14	33,978.66	27,109.60	169,419.85
SUTTER	56,589.08	34,320.48	31,983.16	17,486.49	140,379.20
SANTA BARBARA	37,658.98	40,827.35	27,263.70	25,957.05	131,707.07
COLUSA	23,002.95	58,128.37	9,976.32	16,424.53	107,532.17
TULARE	26,976.80	32,608.76	24,887.99	16,294.93	100,768.47
Sum of Top 15 Counties	1,190,690.11	1,572,886.30	961,741.60	873,303.39	4,598,621.39
Percent of CA Total	83	87	82	84	84
Total Statewide Use	1,435,234.09	1,809,522.01	1,177,368.07	1,039,896.04	5,462,020.22

Table 5 Monthly Acephate Use by County for the Years 1997-2000

COUNTY	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
ALAMEDA	77.8	98.6	166.9	203.9	193.4	244.1	254.4	546.1	422.9	167.4	78.7	60.8
AMADOR	0.5	0.4	0.4	0.7	1.2	1.6	0.5	0.2	1.4	0.2	0.2	0.2
BUTTE	12.0	12.7	18.0	28.0	45.3	80.3	268.5	651.2	167.4	15.1	13.6	9.2
CALAVERAS	0.4	0.5	0.4	0.5	0.4	0.3	0.3	0.6	1.8	0.4	0.3	0.2
COLUSA	0.2	0.5	0.1	0.2	475.0	5,830.8	4,408.8	3,441.8	647.1	0.1	0.4	0.5
CONTRA COSTA	100.5	127.5	252.2	291.4	270.8	344.4	518.5	557.6	330.5	210.3	83.5	73.2
DEL NORTE	22.3	30.0	35.8	27.9	41.8	121.4	48.8	80.2	15.0	6.8	3.1	3.8
EL DORADO	2.3	13.0	5.0	71.7	27.5	24.7	21.4	35.7	24.9	6.4	1.5	1.2
FRESNO	5,694.8	11,476.0	13,292.4	318.6	3,026.7	29,122.1	57,341.6	22,192.3	43,071.2	7,192.3	76.5	99.2
GLENN	1.2	3.3	1.2	2.3	2.5	566.1	636.1	2,086.3	299.6	2.4	2.6	2.9
HUMBOLDT	8.9	10.4	10.4	8.5	13.9	37.7	32.5	49.9	26.0	10.4	6.7	8.4
IMPERIAL	2,922.8	1,012.6	606.4	2,410.4	277.4	3,477.6	15,897.1	11,735.1	3,196.5	1,711.9	6,422.7	4,771.0
INYO		0.3		63.8	0.2							
KERN	7,228.9	10,911.0	17,083.4	4,534.9	3,050.7	14,187.3	23,246.1	6,724.9	6,437.4	368.4	574.5	3,796.9
KINGS	10,814.8	17,537.6	24,018.8	1,965.2	97.7	2,058.1	1,646.1	906.6	1,172.4	38.4	13.6	162.3
LAKE	3.3	0.5	0.7	1.0	1.5	1.9	1.1	3.7	5.3	2.5	0.5	0.0
LASSEN	0.0	0.1	0.0	0.0	0.0	0.1	9.0	0.0	3.0	1.1	0.5	0.2
LOS ANGELES	722.0	721.2	790.5	799.6	880.0	1,112.8	1,421.6	1,292.5	1,229.9	970.3	655.4	620.9
MADERA	44.4	9.9	53.6	10.8	133.5	773.1	1,894.5	493.5	132.8	13.4	7.0	9.7
MARIN	26.2	22.7	25.7	49.8	40.8	39.2	29.9	31.7	43.0	28.0	21.6	20.5
MARIPOSA	0.4	0.3	1.0	0.4	3.9	2.3	3.6	0.3	0.6	0.9	0.4	0.6
MENDOCINO	3.3	3.0	8.8	8.3	14.7	33.3	15.8	8.1	8.2	14.1	7.6	8.1
MERCED	7.4	6.9	8.9	57.2	1,227.5	4,095.7	9,126.4	14,120.6	4,290.6	476.7	9.8	4.0
MODOC		0.0					0.0	30.0				
MONO					0.1							
MONTEREY	537.5	2,564.2	28,052.3	45,965.3	43,985.7	43,773.0	53,534.3	68,501.6	33,570.2	2,825.0	640.3	465.4
NAPA	13.9	13.9	24.3	40.6	29.6	21.1	23.2	17.0	16.8	14.6	13.6	12.3
NEVADA	0.1	6.4	4.6	33.0	9.3	1.2	5.9	0.3	1.2	0.7	0.9	0.3
ORANGE	3,102.6	1,224.5	1,377.7	1,479.9	1,603.5	1,643.6	1,675.8	3,341.6	1,870.0	1,512.2	1,570.5	874.4
PLACER	3.1	4.7	126.1	198.2	79.2	185.2	153.3	102.8	130.5	9.3	6.8	7.0
PLUMAS	0.0	0.1	0.9	6.0	4.0	7.9	3.3	2.3				0.3
RIVERSIDE	745.8	647.3	937.7	959.5	1,342.6	2,239.8	11,983.4	9,865.0	6,417.6	930.6	405.4	213.0
SACRAMENTO	23.9	519.9	112.8	694.5	265.3	220.0	586.0	808.4	409.1	99.5	63.2	48.3
SAN BENITO	23.4	151.8	2,088.2	2,776.4	2,514.3	3,077.2	4,968.1	6,127.0	2,552.8	239.9	11.7	12.5
SAN BERNARDINO	75.9	83.5	176.7	264.1	257.1	360.7	1,893.7	1,233.6	384.9	182.7	161.9	140.3
SAN DIEGO	1,759.9	1,506.3	1,749.0	1,995.6	2,007.2	2,185.2	2,488.7	2,713.4	3,541.2	3,048.2	1,443.4	1,282.0
SAN FRANCISCO	131.9	118.5	134.3	129.0	136.0	162.9	129.0	125.5	112.6	126.4	119.8	125.0
SAN JOAQUIN	27.9	52.6	98.5	148.5	192.9	437.0	6,570.8	30,781.3	6,063.0	357.3	33.1	17.3
SAN LUIS OBISPO	439.4	1,044.3	3,351.4	3,867.9	4,112.1	3,176.2	4,217.1	4,168.6	3,587.3	1,642.7	328.3	236.2
SAN MATEO	303.3	285.4	330.2	525.2	347.3	400.6	433.0	473.2	390.9	324.7	209.8	200.7
SANTA BARBARA	810.7	2,421.7	6,299.4	7,449.4	7,190.3	6,980.2	7,333.0	7,525.7	7,622.6	2,692.1	593.3	554.2
SANTA CLARA	241.9	262.9	946.8	1,902.4	1,965.9	2,399.7	3,119.3	3,149.1	2,062.8	602.7	290.8	344.1
SANTA CRUZ	290.8	242.2	1,382.2	2,263.3	2,885.0	2,486.1	2,454.6	3,313.8	2,087.3	421.5	353.4	163.6
SHASTA	4.0	2.5	2.6	17.5	18.1	37.0	25.7	16.0	7.3	9.2	4.6	4.9
SIERRA	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SISKIYOU	1.4	0.3	0.6	1.8	0.9	0.3	213.7	0.3	0.4	1.6	0.8	0.1
SOLANO	38.5	27.1	250.7	245.5	280.7	325.3	3,031.3	5,861.0	962.2	139.3	66.9	26.7
SONOMA	41.3	60.2	98.0	154.8	205.6	226.1	232.2	167.6	108.8	83.2	60.7	54.4
STANISLAUS	12.0	598.9	21.0	18.0	342.3	919.9	22,117.9	48,500.3	14,472.1	301.3	6.7	32.0
SUTTER	0.6	8.3	1.1	1.8	35.2	378.3	11,019.8	10,890.7	4,466.5	0.3	2.1	0.9

TEHAMA	2.3	4.3	3.2	1.7	2.6	3.1	76.8	130.9	2.7	3.4	2.2	4.6
TRINITY		0.0	0.1	0.0						0.0		0.6
TULARE	4,686.5	9,362.0	9,746.8	355.4	1,198.0	2,263.1	4,138.3	3,215.6	1,971.8	111.8	43.1	18.3
TUOLUMNE	0.2	0.1	0.2	0.6	0.3	0.2	0.1	0.3	0.3	0.4	0.2	0.1
VENTURA	2,861.9	3,430.2	5,051.8	3,068.7	1,686.7	969.1	3,278.3	5,707.7	6,933.6	9,227.0	6,194.9	3,501.2
YOLO	8.4	9.3	13.8	18.3	27.5	709.4	721.6	1,906.6	494.1	14.3	11.3	7.2
YUBA	0.8	1.0	0.9	1.1	1.0	1.6	1.4	1.6	1.3	1.3	2.1	0.5

Table 6 Monthly Chlorothalonil Use by County for Years 1997-2000

COUNTY	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
ALAMEDA	155.1	55.6	375.9	255.9	77.6	209.7	350.3	474.2	478.9	414.6	256.2	159.1
AMADOR											19.6	
BUTTE	1.5	119.5	8,901.6	1,156.7	57.3	139.2	328.5	185.1	48.5	2.4	20.7	15.1
CALAVERAS				6.5	26.0	6.5				25.0		35.4
COLUSA	578.4	3,128.4	3,228.9	4,150.0	7,571.6	34,569.9	20,872.3	12,848.3	2,261.2			7.5
CONTRA COSTA	717.8	387.3	748.1	1,296.2	2,796.5	12,117.7	4,515.7	2,073.5	1,216.4	950.1	591.0	521.9
DEL NORTE	568.7	1,499.8	5,260.6	8,304.5	8,063.0	6,282.1	4,148.2	2,028.8	804.8	917.5	695.2	600.4
EL DORADO	96.7	9.6	34.4	0.1	52.9	0.8	14.5	0.3	0.1			2.8
FRESNO	8,387.2	28,904.4	78,795.6	54,942.4	70,806.7	204,195.4	76,893.2	100,439.9	56,081.5	4,234.0	1,504.3	1,272.4
GLENN		500.8	3,549.3	828.6	882.4	716.7	1,752.4	966.7	135.7		16.5	92.3
HUMBOLDT	793.7	720.4	718.6	593.3	469.8	262.4	510.6	466.5	327.4	354.1	621.5	919.5
IMPERIAL	21,329.2	33,304.4	38,002.9	25,159.9	5,333.1	881.8			439.2	490.2	2,184.8	7,697.5
INYO						0.2	0.1	0.1		0.1		
KERN	3,309.6	36,464.8	73,480.2	147,715.2	110,054.8	26,518.5	4,575.0	7,980.6	27,315.8	39,357.3	19,990.0	5,990.4
KINGS	433.5	3,653.2	10,581.7	10,449.3	6,497.9	28,552.2	14,788.9	8,381.0	7,545.2	2,613.7	2,199.1	
LASSEN					113.0	41.7		175.6				
LOS ANGELES	3,600.0	1,907.6	2,109.8	2,665.5	3,616.3	6,649.7	7,537.8	6,712.6	5,164.7	2,692.6	2,265.5	1,863.3
MADERA	229.0	1,657.9	7,812.4	1,698.5	4,190.0	7,821.8	1,432.9	1,182.7	1,954.7	336.4	555.1	44.5
MARIN	44.6	1.7	22.3	32.4	29.2	40.0	28.0	95.3		70.1	0.3	0.8
MARIPOSA	1.1	3.2	4.7	0.5		20.9				1.1	1.9	1.1
MENDOCINO	9.7	0.1	0.5	0.2	0.2	32.5	15.8	30.2	34.4	1.1	1.4	0.5
MERCED	151.4	527.9	8,583.6	1,774.4	922.9	5,153.1	1,811.6	50,350.3	56,410.8	15,883.8	552.9	46.4
MODOC					884.2	3,635.9	13,175.4	13,421.9	1,999.7			
MONO								105.5	305.9		15.6	
MONTEREY	1,865.9	3,098.3	6,568.7	7,127.8	6,235.3	8,744.0	12,247.6	22,763.4	22,988.8	13,822.9	3,812.3	1,155.6
NAPA	36.1	42.7	14.8	32.6	63.8	96.9	117.6	106.2	130.4	128.1	30.2	21.0
NEVADA	0.0	0.1	0.2	0.5	65.7	0.6	18.8	79.6	24.3	42.3	0.1	0.0
ORANGE	3,356.0	3,799.5	4,134.9	3,987.0	5,734.5	8,035.6	8,666.9	12,686.2	7,885.8	7,147.0	5,875.2	3,565.4
PLACER	31.3	69.0	801.2	1.9	52.9	57.3	77.7	89.4	154.7	273.4	79.4	76.9
PLUMAS					16.5	16.5	60.2	53.9	31.0	39.0	60.1	33.0
RIVERSIDE	3,516.9	3,447.4	10,414.2	4,383.7	4,096.1	2,945.9	3,778.8	5,472.1	5,362.5	7,962.5	5,915.7	3,502.8
SACRAMENTO	132.8	95.0	634.3	204.4	426.7	1,286.7	4,475.1	13,493.8	11,259.9	2,098.5	183.6	86.2
SAN BENITO	81.5	267.1	922.7	1,439.4	1,954.2	5,186.8	8,671.2	7,101.7	2,089.5	877.0	151.7	65.3
SAN BERNARDINO	606.8	856.2	1,026.8	751.6	621.0	1,544.0	858.7	820.7	803.3	876.6	663.9	683.7
SAN DIEGO	2,655.5	3,573.8	3,964.4	5,533.1	8,156.1	11,094.4	14,757.9	22,106.2	22,922.7	23,142.9	10,389.7	3,804.3
SAN FRANCISCO	94.9	91.2	174.2	2.1	74.3	315.3	271.0	216.0	86.4	235.1	33.0	58.0
SAN JOAQUIN	609.7	1,815.8	9,694.7	4,375.7	8,531.6	9,140.9	9,226.6	44,403.9	54,283.3	13,693.3	858.3	131.3

SAN LUIS OBISPO	1,368.6	1,788.3	6,220.3	3,927.1	4,446.7	3,503.4	3,676.5	2,350.6	3,579.2	2,698.5	2,699.5	2,084.1
SAN MATEO	865.3	505.4	439.1	192.1	383.7	1,118.5	2,368.3	2,662.8	3,234.0	1,684.2	956.8	405.4
SANTA BARBARA	2,327.2	2,126.6	2,577.1	4,641.0	5,683.5	6,129.3	10,237.0	8,161.2	9,063.4	6,922.2	5,548.6	3,843.6
SANTA CLARA	266.1	437.4	1,279.5	959.0	1,447.8	2,314.4	4,138.6	2,190.9	1,269.4	430.7	419.2	293.6
SANTA CRUZ	165.0	229.9	250.0	257.7	367.3	446.5	1,529.0	2,882.7	5,030.5	5,000.3	2,074.2	212.7
SHASTA	127.9	51.6	81.2	202.3	144.0	375.6	568.9	541.8	349.0	310.8	263.1	77.9
SISKIYOU		63.3	0.0	0.8	328.0	2,515.8	21,095.9	21,865.6	1,734.6			
SOLANO	12.3	77.9	1,008.5	128.2	89.2	1,323.9	4,029.3	19,695.8	9,384.2	765.4	132.9	49.0
SONOMA	6.3	116.6	45.1	50.6	119.3	187.5	50.8	156.3	109.4	216.0	291.4	78.4
STANISLAUS	75.8	1,294.6	28,303.7	1,984.0	746.2	2,177.5	3,066.8	17,857.6	19,824.6	4,888.3	219.4	57.6
SUTTER	344.7	336.1	18,196.2	474.6	178.9	2,928.1	13,858.9	33,418.3	9,417.9	0.1		55.2
TEHAMA			3,211.2	88.6	21.0	6.1	13.0	36.2	61.6	47.4	25.6	
TRINITY	2.1	2.1										2.1
TULARE	792.7	16,947.9	26,049.2	3,048.0	1,045.1	3,397.8	2,019.6	4,117.2	2,561.4	430.9	190.0	69.9
TUOLUMNE		6.0	9.0	2.9				45.9				
VENTURA	41,724.5	37,185.7	34,086.2	22,996.4	17,299.9	9,453.6	13,420.8	10,439.5	13,970.8	28,988.1	36,284.3	29,206.2
YOLO	369.3	412.1	1,039.1	542.6	1,409.9	17,100.0	18,325.9	76,565.8	33,450.5	498.6	115.4	107.8
YUBA	0.3	0.2	8,715.5	922.1	10.1	22.6	8.3	102.1	33.4	20.9	20.9	0.1

Table 7 Monthly Methamidophos Use by County for the Years 1997-2000

COUNTY	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
AMADOR				201.4			56.4	141.7	123.5			
BUTTE						0.0		2.2				
COLUSA					56.9	517.7	1,886.7	805.4	243.5			
FRESNO	659.3	30.9	855.4	449.3	37,921.7	39,448.8	37,142.6	96,836.5	6,398.7	193.5	124.6	54.1
GLENN							73.7	169.3				
IMPERIAL	2,107.8	6,163.5	8,540.3	3,684.8	10,143.7	21,709.1	10,999.8	7,358.8	1,409.4	703.3	1,979.4	275.7
KERN		209.6	2,155.7	4,142.4	11,095.1	26,558.1	36,399.3	25,992.6	4,151.3	999.5		
KINGS				1,512.0	25,403.0	10,011.5	59,871.1	28,640.9	778.6		47.5	47.5
LASSEN		0.8										
LOS ANGELES	11.4								1.5			
MADERA						307.3	365.1	314.7	281.6			
MERCED		0.0			485.1	3,966.6	6,485.5	3,007.3	1,356.3	201.8		
MODOC							4,809.1	2,885.0	119.0			
MONTEREY	436.8	417.4	530.0	646.3	606.1	1,674.5	5,662.2	7,273.3	5,282.8	1,475.8	552.3	148.1
ORANGE					153.6					156.9		
RIVERSIDE	62.5	60.0	247.8	842.2	162.2		399.8		253.5	1,160.7		5.5
SACRAMENTO			69.6	30.2			1,857.2	1,866.3	825.7	29.7		
SAN BENITO			42.6	4.9		40.6	143.2	360.2	251.2	83.3		
SAN DIEGO	335.2	219.9	1,061.6	1,560.4	715.6	916.3	1,935.5	2,666.4	601.6	456.7	362.3	767.3
SAN JOAQUIN			77.9	82.5	734.6	2,702.2	6,320.1	10,243.1	6,721.6	760.1		
SAN LUIS OBISPO				158.6	4.5	86.9	248.2	376.5	908.5	174.7		
SAN MATEO							33.7	92.2	99.1	145.3	37.2	
SANTA BARBARA		3.0				1,295.5	2,414.8	1,879.2	1,227.4	141.4	12.5	

SANTA CLARA			27.6			3.8		95.8	105.2			
SANTA CRUZ		1.6					533.3	640.3	1,058.1	738.6	124.8	
SIERRA								0.1				
SISKIYOU						468.4	7,105.9	4,889.1	33.7			
SOLANO					48.3	498.5	1,920.1	4,891.1	2,104.4	725.9		
SONOMA				1.5				0.5				
STANISLAUS				13.0			504.3	1,173.9	3,635.7	576.4		
SUTTER					308.7	2,550.5	18,558.5	11,283.2	1,614.1	49.5		
TULARE				385.4	350.0	1,119.2	1,034.1	99.4				
VENTURA	73.3	56.0	160.9	196.5	388.2	1,054.8	1,302.0	999.3	1,147.9	702.3	428.9	143.1
YOLO					389.3	2,459.0	12,430.1	10,260.3	3,336.4			
YUBA									177.2			

Table 8 Monthly Use of Acephate, Chlorothalonil, and Methamidophos in California for Years 1997-2000

(Pounds of Active Ingredient)

Month	Acephate	Chlorothalonil	Methamidophos	Total
JANUARY	43,884.4	101,842.7	3,686.5	149,413.5
FEBRUARY	66,653.6	191,584.6	7,162.7	265,400.9
MARCH	118,764.4	412,073.3	13,769.4	544,607.1
APRIL	85,439.2	329,287.7	13,911.6	428,638.4
MAY	82,553.6	292,194.8	88,966.9	463,715.3
JUNE	137,746.0	439,314.7	117,389.3	694,450.0
JULY	263,252.4	314,386.8	220,492.5	798,131.7
AUGUST	283,637.8	540,402.4	225,244.8	1,049,285.0
SEPTEMBER	161,769.4	403,621.2	44,247.3	609,637.9
OCTOBER	36,160.8	191,585.2	9,475.2	237,221.2
NOVEMBER	20,622.7	108,786.2	3,669.4	133,078.3
DECEMBER	18,001.9	68,997.8	1,441.3	88,441.0
TOTAL	1,318,486.1	3,394,077.4	749,456.7	5,462,020.2

Table 9 Annual Use of Acephate by Commodity
(Pounds of Active Ingredient)

Crop	1997	1998	1999	2000	Total
LETTUCE, HEAD (ALL OR UNSPEC)	109,418	112,824	121,520	98,376	442,138
COTTON, GENERAL	80,167	114,594	67,444	66,444	328,649
BEANS, DRIED-TYPE	49,658	51,860	35,908	34,196	171,622
CELERY, GENERAL	23,662	25,077	21,419	19,043	89,201
BEANS, SUCCULENT (OTHER THAN LIMA)	21,633	19,529	14,772	18,080	74,013
OUTDOOR CONTAINER/FIELD GROWN PLANTS	6,499	6,789	8,238	8,386	29,911
PEPPERS (FRUITING VEGETABLE), (BELL, CHILI, ETC.)	7,020	7,040	6,698	7,833	28,591
STRUCTURAL PEST CONTROL	7,914	7,522	4,946	4,525	24,906
LANDSCAPE MAINTENANCE	5,737	4,577	5,882	8,425	24,620
GREENHOUSE GROWN CUT FLOWERS OR GREENS	9,038	7,554	4,676	2,937	24,205
BEANS (ALL OR UNSPEC)	8,790	4,604	2,577	4,253	20,224
OUTDOOR GROWN CUT FLOWERS OR GREENS	4,612	3,937	3,716	3,223	15,489
Others	9,692	18,184	9,476	7,565	44,917
Total	**343,840**	**384,090**	**307,271**	**283,284**	**1,318,486**

Table 10 Annual Use of Chlorothalonil by Commodity
(Pounds of Active Ingredient)

Crop	1997	1998	1999	2000	Total
TOMATOES, FOR PROCESSING/CANNING	226,559	349,095	267,315	202,719	1,045,688
POTATO (WHITE, IRISH, RED, RUSSET)	113,243	170,879	75,710	72,166	431,997
ONION (DRY, SPANISH, WHITE, YELLOW, RED, ETC.)	58,872	111,402	55,875	81,469	307,619
CELERY, GENERAL	74,717	109,863	58,395	61,033	304,008
TOMATO	76,327	99,429	59,433	58,426	293,615
LANDSCAPE MAINTENANCE	37,884	34,720	41,985	52,063	166,652
CARROTS, GENERAL	34,341	35,080	26,952	33,120	129,492
GARLIC	4,901	96,343	6,924	4,669	112,837
PRUNE	16,106	16,933	25,602	11,282	69,922
PEACH	11,813	19,069	14,006	11,634	56,522
BROCCOLI	18,433	14,230	11,664	10,869	55,196
NECTARINE	16,250	13,223	10,821	11,611	51,905
Others	89,883	110,890	99,159	68,685	368,617
Total	**779,328**	**1,181,156**	**753,840**	**679,747**	**3,394,077**

Table 11 Annual Use of Methamidophos by Commodity
(Pounds of Active Ingredient)

Crop	1997	1998	1999	2000	Total
ALFALFA (FORAGE - FODDER) (ALFALFA HAY)	99,084	61,568	55,378	36,122	252,152
COTTON, GENERAL	85,714	114,377	17,900	17,676	235,667
TOMATOES, FOR PROCESSING/CANNING	25,851	30,225	18,594	8,330	83,000
POTATO (WHITE, IRISH, RED, RUSSET)	22,967	10,682	12,177	8,800	54,626
TOMATO	20,797	15,265	9,067	4,034	49,163
SUGARBEET, GENERAL	21,988	7,098	551	853	30,490
BROCCOLI	14,627	2,411	1,206	691	18,935
BRUSSELS SPROUTS	2,882	745	445	106	4,179
MELONS	3,593	384	199		4,176
CAULIFLOWER	3,368	291	186	54	3,899
CABBAGE	3,211	428	47	44	3,731
LETTUCE, HEAD (ALL OR UNSPEC)	2,838				2,838
Others	5,147	793	508	155	6,602
Total	**312,067**	**244,269**	**116,256**	**153,731**	**749,457**

C. RECOMMENDATIONS

Ambient Air Monitoring

DPR recommends that monitoring should coincide with areas and times of peak pesticide use. Based on the pesticide use pattern from previous years, ambient monitoring for acephate, chlorothalonil, and methamidophos should occur in Fresno County and possibly northern Kings County over a three-month period during June through August. Ideally, monitoring for all three pesticides would occur concurrently for 12 consecutive weeks between June 2 and August 24, 2002. If this cannot be done, monitoring for chlorothalonil should occur for 6 consecutive weeks between May 26 and July 6, 2002; and monitoring for acephate and methanidophos should occur for seven consecutive weeks between July 7 and August 24, 2002. Figures 4(a), 4(b), and 4(c) demonstrate acephate, chlorothalonil and methamidophos use, respectively, in Fresno County during the period from June 1 through August 31 in 1997, 1998, 1999, and 2000. Attachments A, B, and C (1-4) display acephate, chlorothalonil, and methamidophos use, respectively, by section in the Central Valley during 1997-2000.

For chlorothalonil monitoring study, samples should be collected and analyzed for chlorothalonil. For acephate and methanidophos monitoring study, some samples will be

targeted for acephate and some for methamidophos. The acephate samples should be analyzed for both acephate and methamidophos, but not *vice versa*; i.e. the methanidophos samples would be analyzed for methanidophos only. Except for methamidophos, no other breakdown products need to be monitored. Based on a preliminary assessment of the toxicology data, DPR requests the target 24-hour quantitation limits = 1 ng/m³ for chlorothalonil, 5 ng/m³ for acephate, and 1 ng/m³ for methamidophos.

Five sampling sites plus one urban background site should be selected in relatively high-population areas or in areas frequented by people (e.g. schools or school district offices, fire stations, or other public buildings). Background samples should be collected in an area distant to applications of acephate, chlorothalonil, and methamidophos. All sampling sites should be free of any obstacles (e.g. trees, buildings) within 50 meters. At each sampling site, 4 samples per week should be collected during the sampling period.

DPR recommends close coordination with the county agricultural commissioner to select the best sampling sites and periods. In addition to the primary samples, replicate (co-located) samples are needed for 4 random dates at each sampling location. Field spikes should be sampled randomly at the same environmental conditions (e.g. temperature, humidity, wind) and monitoring study conditions (e.g. air flow rates, exposure to sunlight) as those during ambient sampling. DPR request that the ambient monitoring report should include:

1) the proximity, including the distance and direction, of the sampler to treated or potentially treated fields;
2) the distance of each sampler located above the ground;
3) the information relevant to the monitoring study (e.g. trees, buildings, particular industrial or commercial facilities and activities) for the sampler surrounding areas; and
4) latitude and longitude coordinates for sampling sites with a description of which Datum was used (i.e. NAD 27 or NAD 83).

Figure 4(a) Acephate Applications in Fresno County (June-August)

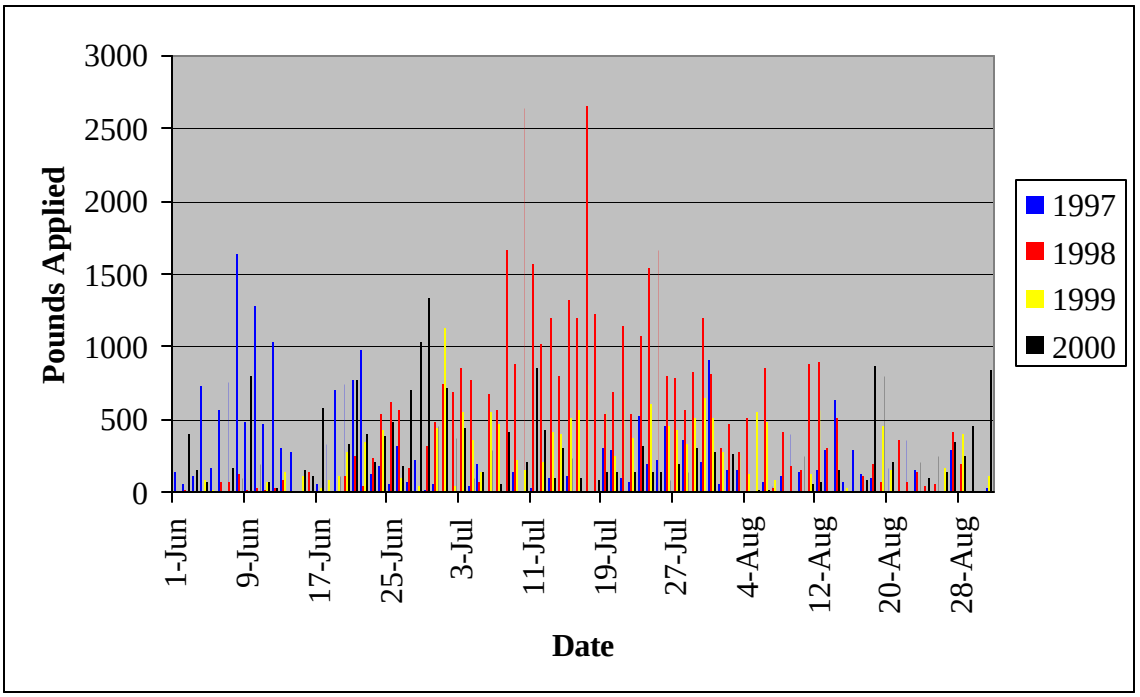


Figure 4(b) Chlorothalonil Application in Fresno County (June-August)

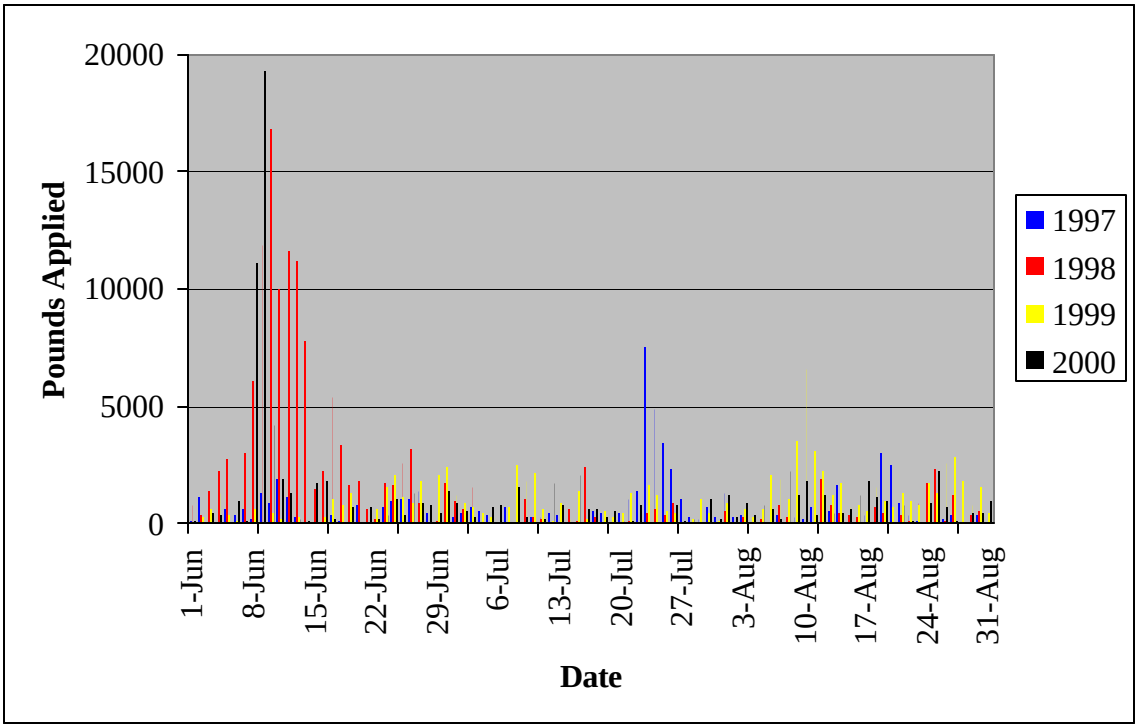
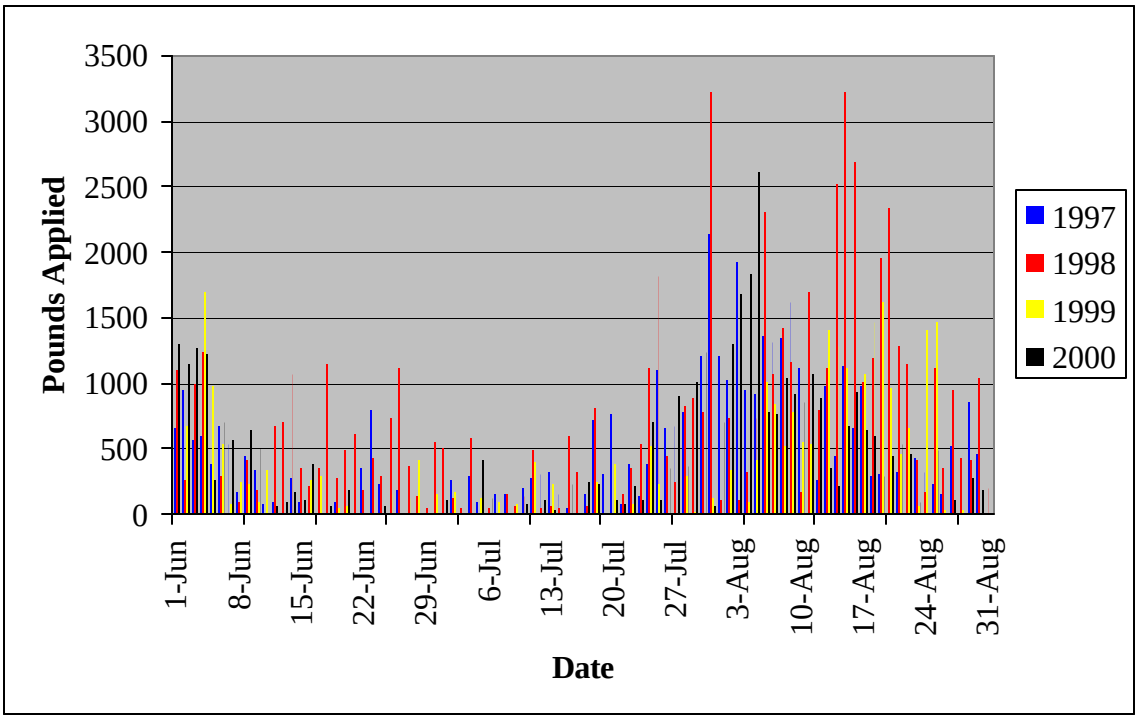


Figure 4(c) Methamidophos Applications in Fresno County (June-August)



Application-Site Air Monitoring

Application monitoring should be conducted for the chemicals acephate, chlorothalonil, and methamidophos. If possible, concurrent monitoring for all three chemicals is preferred. Otherwise, for acephate applications sampling and analysis should be accomplished for both acephate and methamidophos simultaneously. Except for methamidophos, no other breakdown products need to be monitored, i.e. for methamidophos or chlorothalonil application studies, only methamidophos or chlorothalonil should be monitored. DPR recommends that monitoring should occur at a site using the highest allowed use rates (i.e. 1 pound AI per acre for acephate and methamidophos, and 5 pounds AI per acre for chlorothalonil). DPR does not request specific application methods. The target quantitation limits for application monitoring study are 0.1, 5, and 0.05 µg/m^3 for acephate, chlorothalonil, and methamidophos, respectively.

DPR recommends close coordination with the county agricultural commissioner to select the best sampling sites and date. The application monitoring study should include samples taken before, during, and after application with 72 hours duration of post-application according to the following sampling schedule:

Sample period begins:	**Sample duration time**
Background (pre-application)	Minimum 12 hours and long enough to meet the recommended quantitation limits
During application	Length of application time
End of application	1 hour
1 hour post-application	2 hours
3 hour post-application	3 hours (or up to 1 hour before sunset)
6 hour post-application	6 hours (or up to 1 hour before sunset)
1 hour before sunset	Overnight[1] (until 1 hour after sunrise)
1 hour after sunrise	Daytime (until 1 hour before sunset)
1 hour before sunset	Overnight (until 1 hour after sunrise)
1 hour after sunrise	24 hours (until 1 hour after sunrise)

[1]All overnight samples must include the period from one hour before sunset to one hour after sunrise.

If application occurs at night, the alternate day-night schedule should be followed. In the occurrence that application takes two or more days, samples should be collected for each daytime application and an overnight sample between the end of the daily application and the start of the next morning application. i.e. the first daytime application, an overnight sample, the second daytime application, an overnight sample, … Regardless of application duration, the study should include **at least** one 1-hour sample taken immediately following the end of application and one 2- to 3-hour sample (taken following the 1-hour sample).

The selected field should be 10 acres or larger. A minimum of eight samplers should be positioned, one on each side of the field and one at each corner. A ninth replicate sampler should be co-located at one position, preferably, downwind. Samplers should be placed approximately 20 meters from edges of the application field. Field spikes should be sampled randomly at the same environmental conditions (e.g. temperature, humidity, wind) and monitoring study conditions (e.g. air flow rates, exposure to sunlight) as those during application sampling.

DPR request that the application monitoring report should include:

1) an accurate record of each sampler's position with respect to the application field, including the exact distance and direction from the field and the orientation of the field with respect to North (identified as either true or magnetic North);
2) the elevation of each sampling station with respect to the field and the distance the sampler located above the ground;
3) in case of application enduring for two or more days, an record how the field is divided for application each day over the entire application period;
4) the start and end time of the application each day;
5) an accurate drawing of the monitoring site indicating the precise location of the meteorological equipment, trees, buildings, and other obstacles;

6) meteorological data collected at a minimum of 15-minute intervals including wind speed and direction, humidity, air temperature, and comments regarding degree of cloud cover, etc.; and
7) if possible, the soil physicochemical properties and crop history of the treated field.

D. SAFETY RECOMMENDATIONS

Most of the following safety precautions pertain to applicators. In this recommendation, the sampling schedule is arranged to prevent sampling personnel from being near the field during application. Therefore, most of these precautions are for reference only.

Acephate

The acephate product labels warn that acephate may be harmful if swallowed and cause eye irritation. Applicators should avoid breathing dust or spray mist and wash hands thoroughly after handling. Children and pets should not come into treated areas until the sprays have dried.

According to the product labels, proper protective equipment (PPE) for applicators, handlers, mixers, and loaders include long-sleeve shirt and long pants, waterproof gloves, footwear plus socks, and chemical resistant headgear (for overhead exposure). PPE is also required for early entry (restricted-entry interval of 24 hours) to treated areas where contact may occur with anything that has been treated. Monitoring personnel should prevent exposure to the spray mist and treated plants, soil, or water and should refer to the label of the actual product used for further precautions.

Chlorothalonil

The chlorothalonil product labels alert that chlorothalonil is hazardous to humans and domestic animals. Chlorothalonil is corrosive, causes irreversible eye damage, and may cause allergic reactions in some individuals with prolonged or repeated skin contact. Inhalation may be fatal. Chlorothalonil products may be harmful if swallowed or absorbed through the skin.

The label advises that applicators, mixers, loaders and other handlers must wear: log-sleeve shirt and long pants, chemical resistant gloves, shoes and socks, protective eyewear, and a dust/mist filtering. The restricted-entry interval varies by product from 12 to 48 hours. Monitoring personnel should refer to the label of the product used and should use proper protective equipment to prevent exposure to the dust or spray mist.

Methamidophos

The methamidophos product labels warn that methamidophos is hazardous to humans and domestic animals. It is fatal if swallowed, inhaled, or absorbed through skin. The

label warns not to breathe vapor or mist and that the product is rapidly absorbed through the skin.

Monitoring personnel should use proper protective equipment to prevent exposure to the vapors or spray mist and refer to the label of the actual product used for further precautions. According to the product labels, PPE for applicators and other handlers include coveralls over short sleeve shirt and short pants, chemical resistant gloves = 14 mils, chemical resistant footwear plus socks, protective eyewear, chemical resistant headgear (for overhead exposure), a chemical resistant apron when cleaning, mixing, or loading, and a respirator with an organic-vapor removing cartridge with a pre-filter for pesticides or a canister approved for pesticides or a NIOSH approved respirator with an organic vapor cartridge or a canister with any N, R, P, or HE prefilter. The restricted-entry interval (REI) is 48 hours, the REI is increased to 72 hours in outdoor areas where rainfall is less than 25 inches per year.

E. REFERENCES

DPR, 1997-2000. Annual Pesticide Use Reports. California Department of Pesticide Regulation, Sacramento, California.

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DPR, 2001b. Pesticide Label Database. California Department of Pesticide Regulation, Sacramento, California.

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Meister, Richard T. (ed) 1996. The Farm Chemicals Handbook. Meister Publishing Company. United States.

Montgomery, John H. 1997. Agrochemicals Desk Reference. 2nd Edition. Lewis Publishers, New York, New York.

The Agrochemicals Handbook, 3rd edition. 1991. Royal Society of Chemistry, Information Services.

Tomlin, C. (ed) 1997. The Pesticide Manual: Eleventh Edition. Crop Protection Publications, British Crop Protection Council and the Royal Society of Chemistry. United Kingdom.

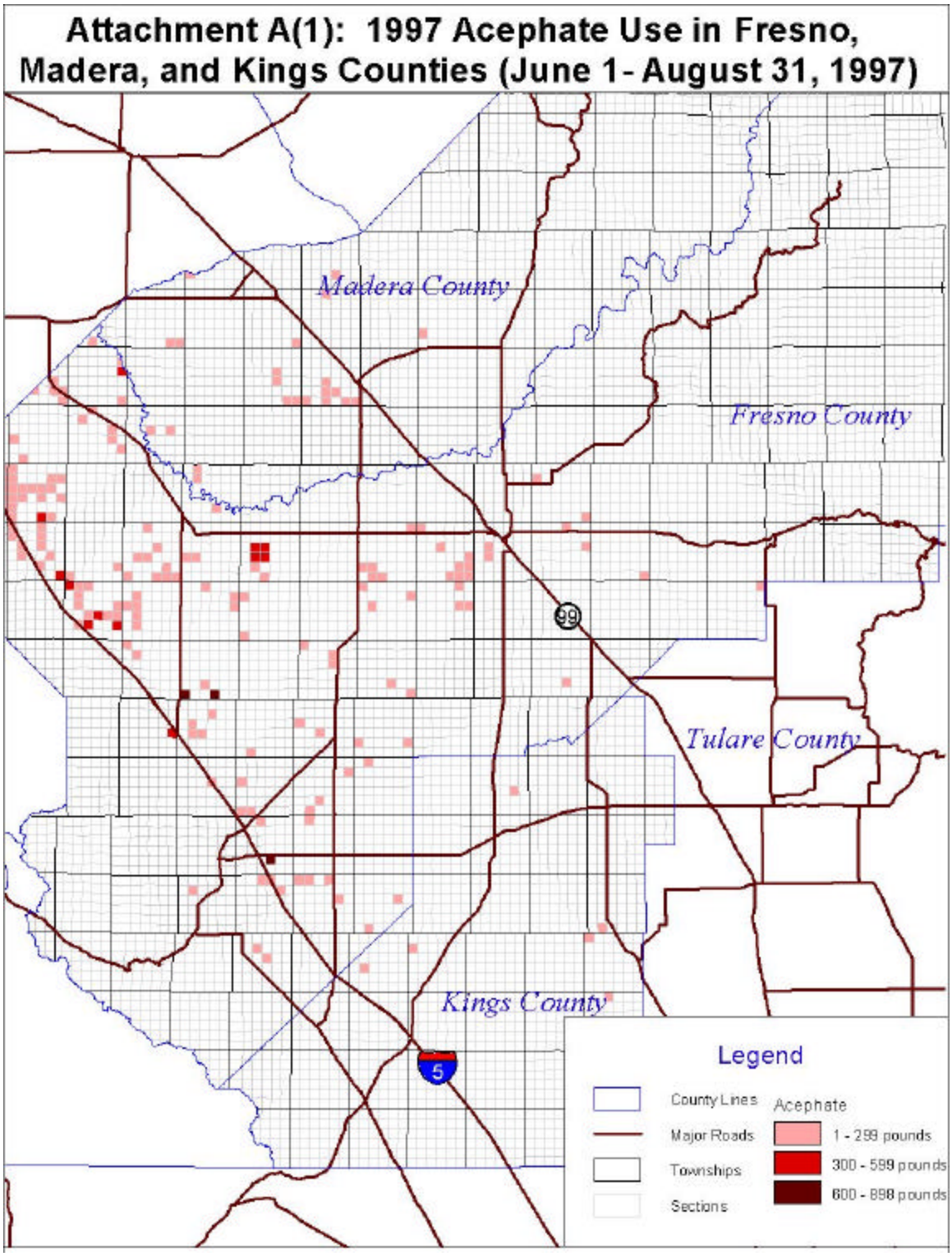
US EPA, 1998a. Revised Environmental Fate and Effects Assessment, Acephate RED Chapter. Preliminary report.

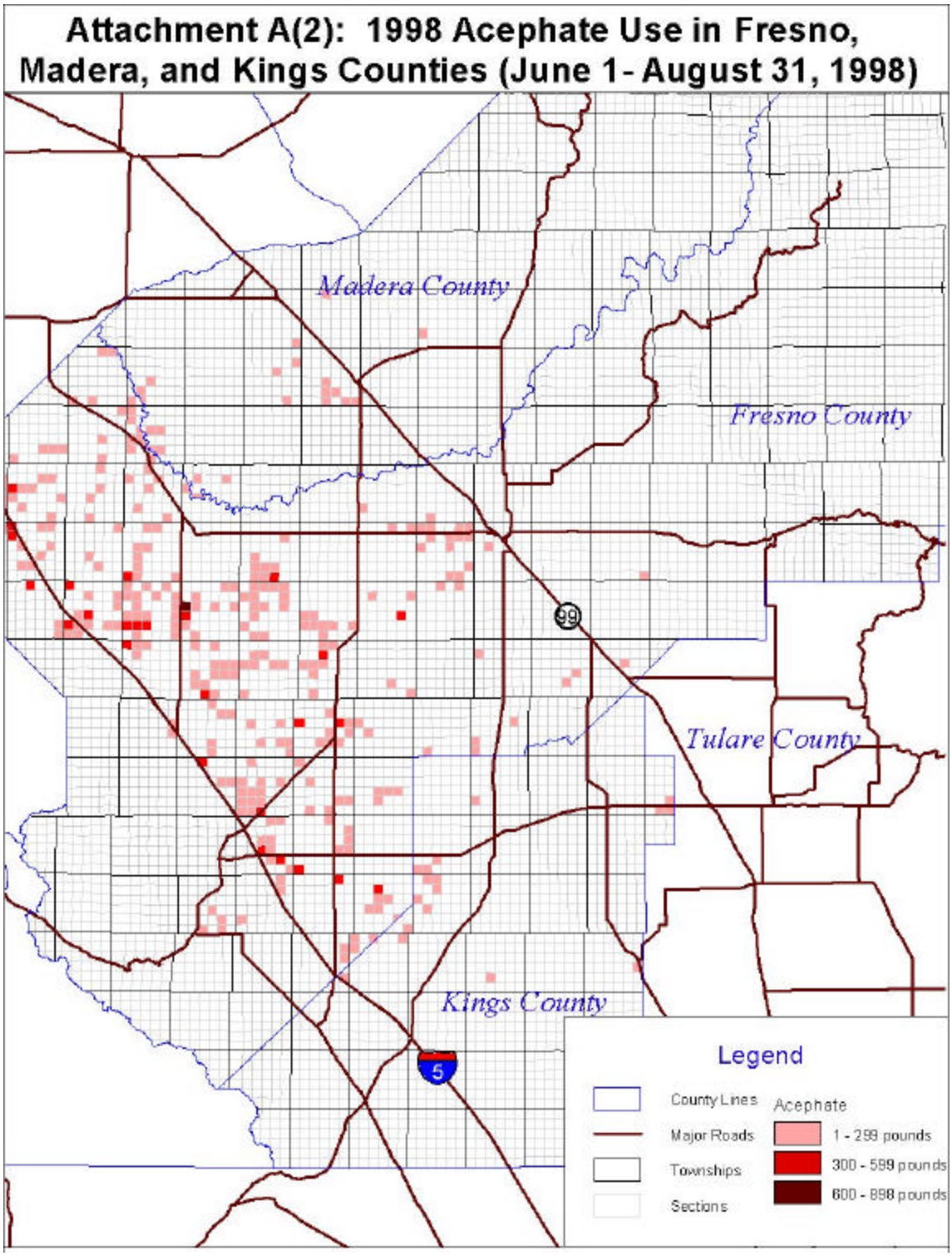
US EPA, 1998b. Revised Environmental Fate and Effects Assessment, Methamidophos RED Chapter. Preliminary report.

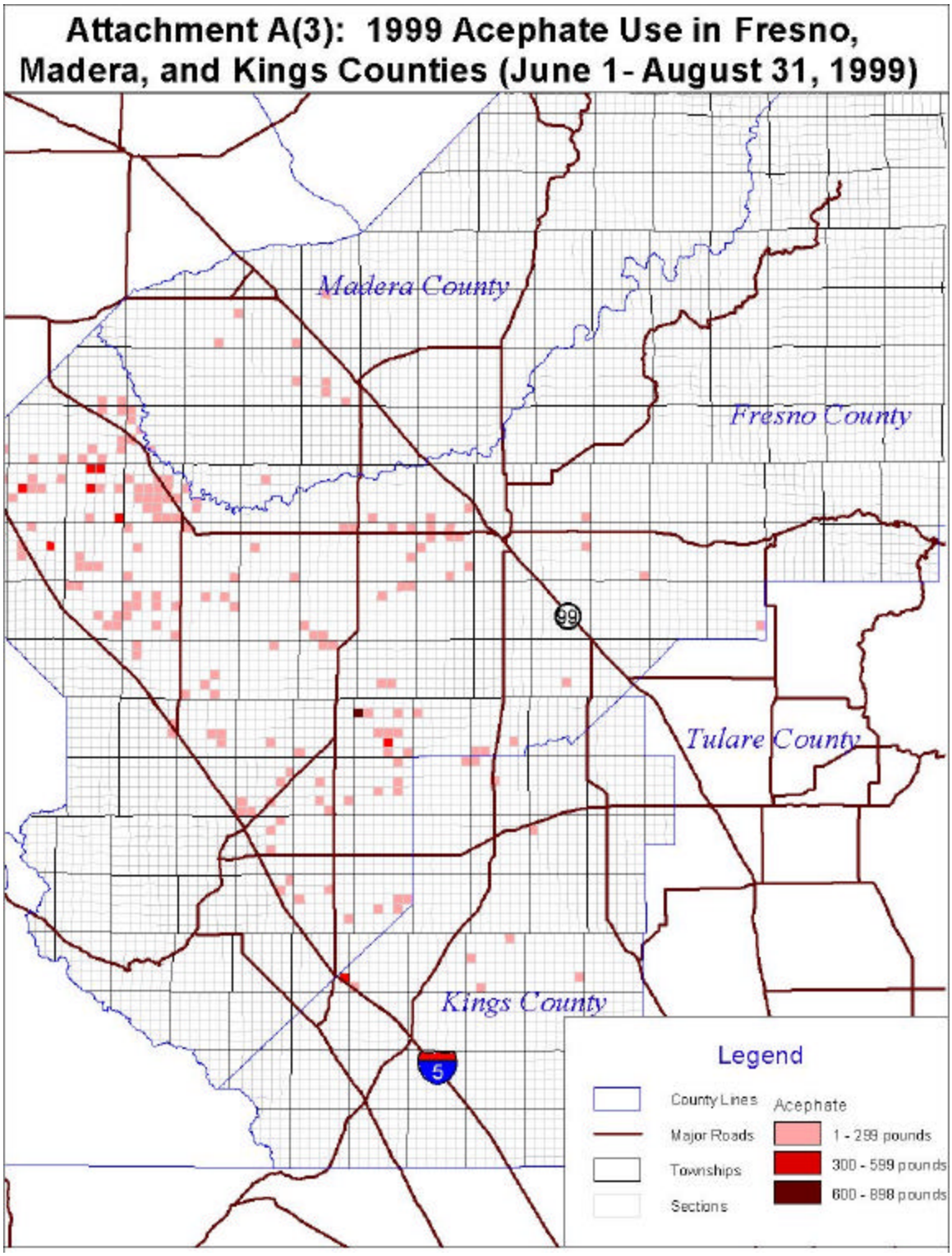
US EPA, 1999. R.E.D Fact Sheet, Chlorothalonil.

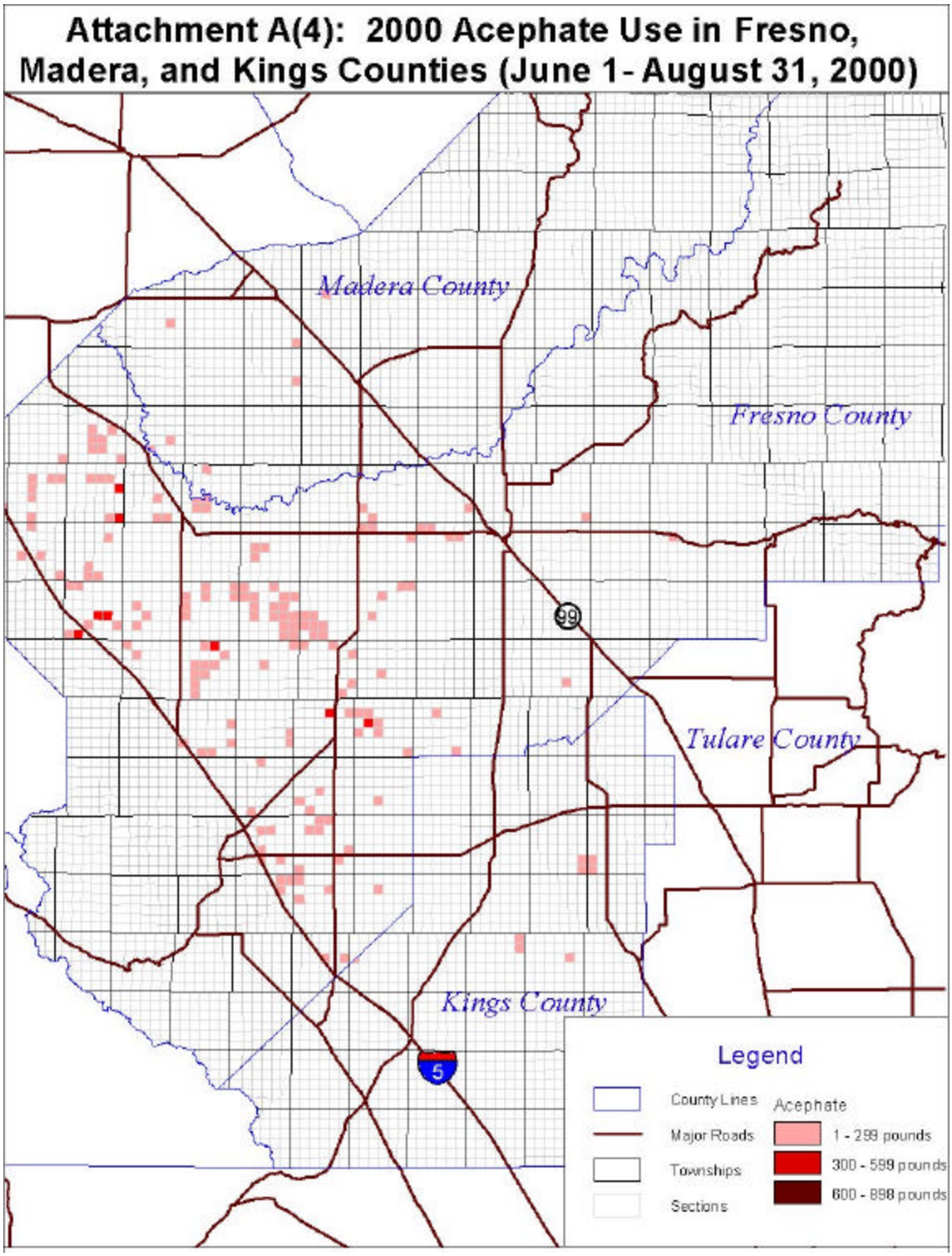
F. Attachment of Pesticide Use Maps

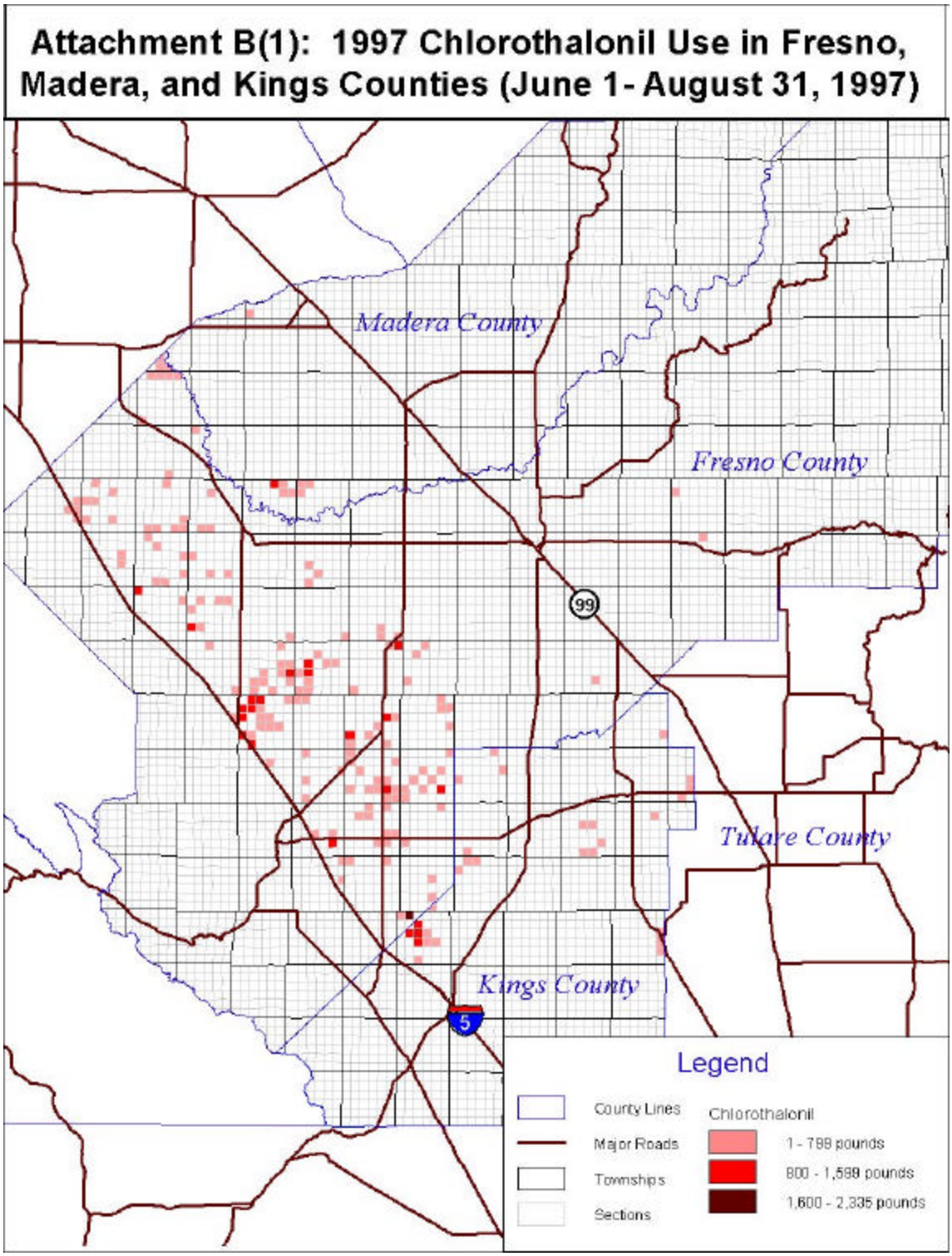
(Fresno, Kings, and Madera Counties, 1997-2000)

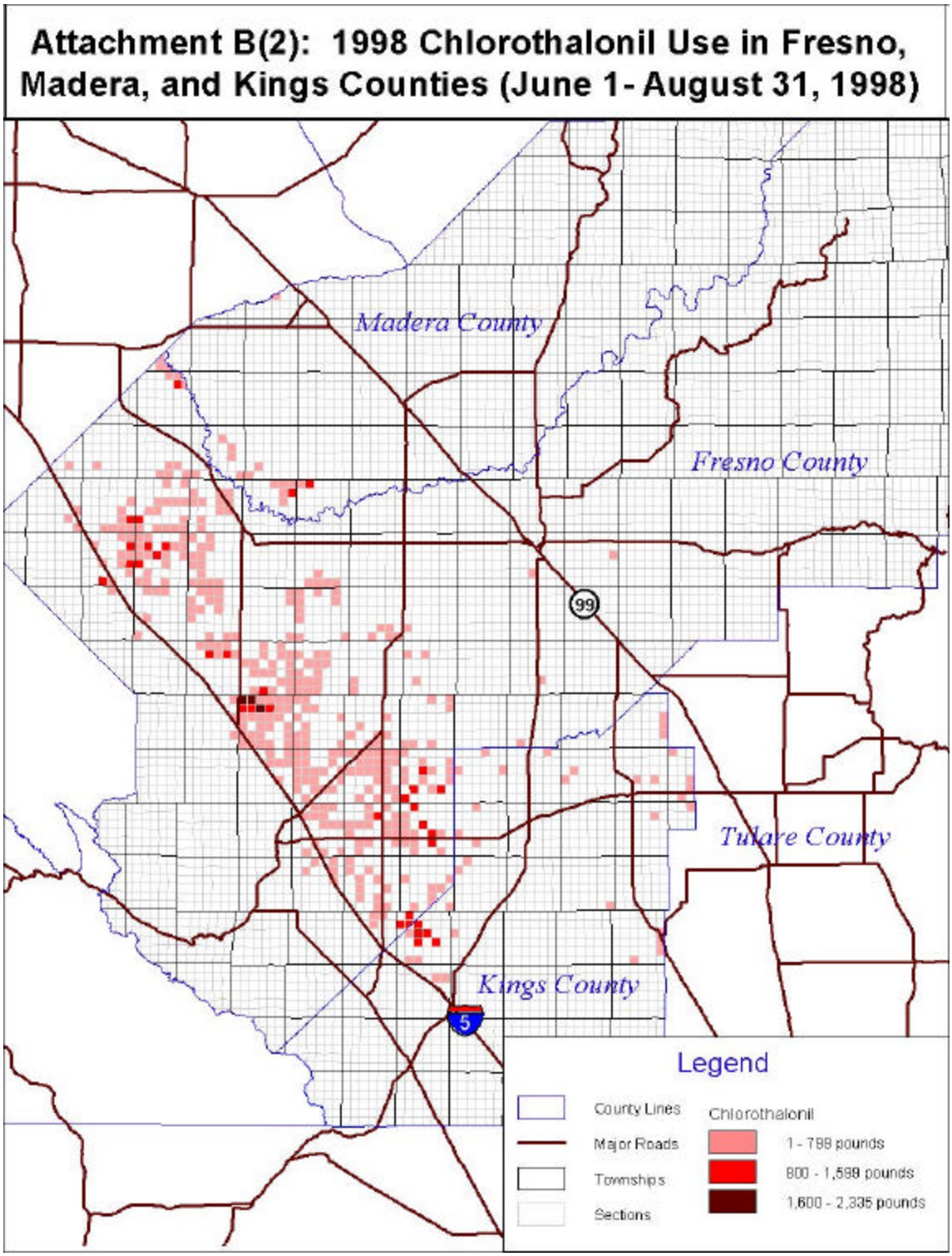

Attachment A(1): 1997 Acephate Use in Fresno, Madera, and Kings Counties (June 1 - August 31, 1997)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Acephate
1 - 299 pounds
300 - 599 pounds
600 - 898 pounds

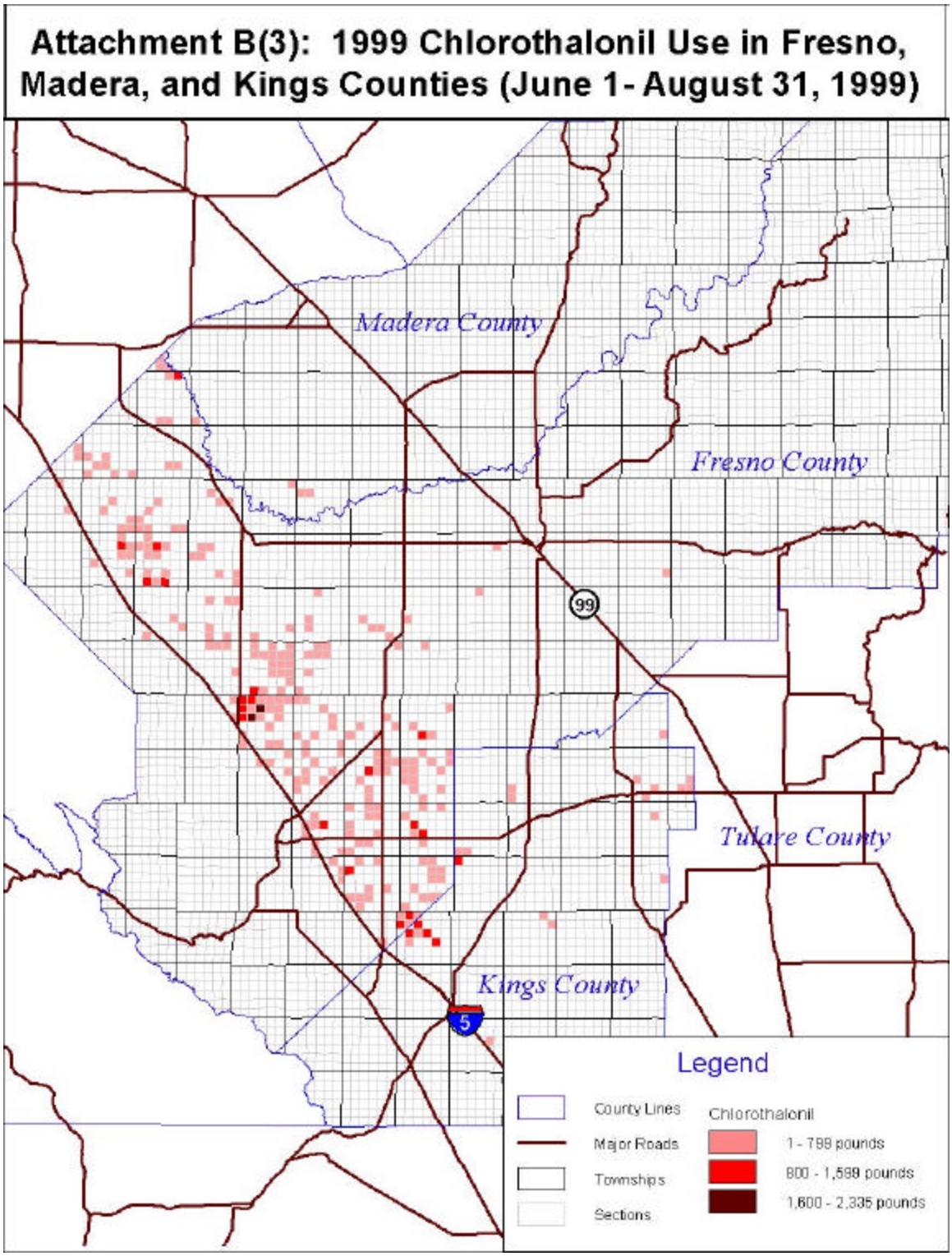

Attachment A(2): 1998 Acephate Use in Fresno, Madera, and Kings Counties (June 1 - August 31, 1998)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Acephate
1 - 299 pounds
300 - 599 pounds
600 - 898 pounds

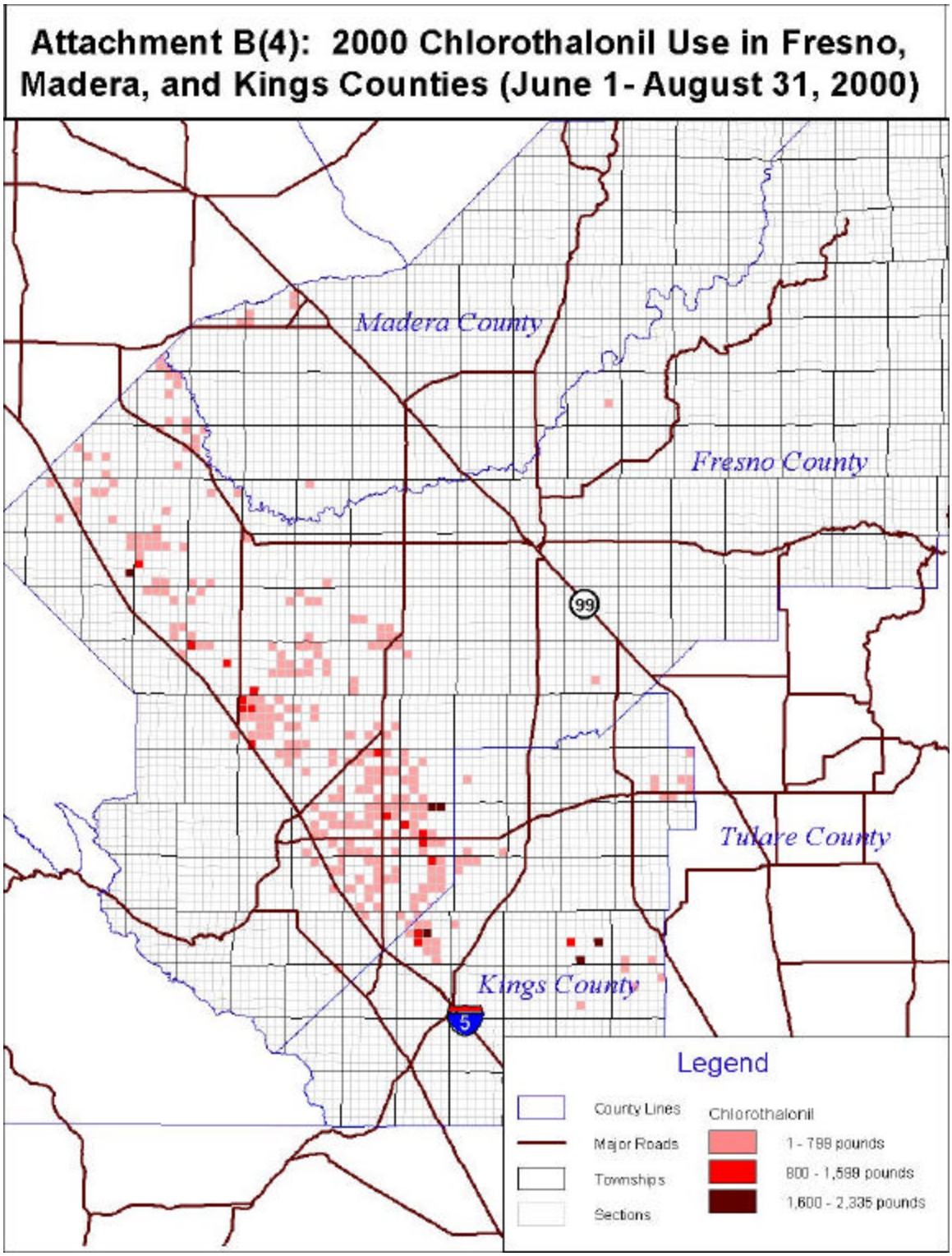

Attachment A(3): 1999 Acephate Use in Fresno, Madera, and Kings Counties (June 1 - August 31, 1999)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Acephate
1 - 299 pounds
300 - 599 pounds
600 - 898 pounds

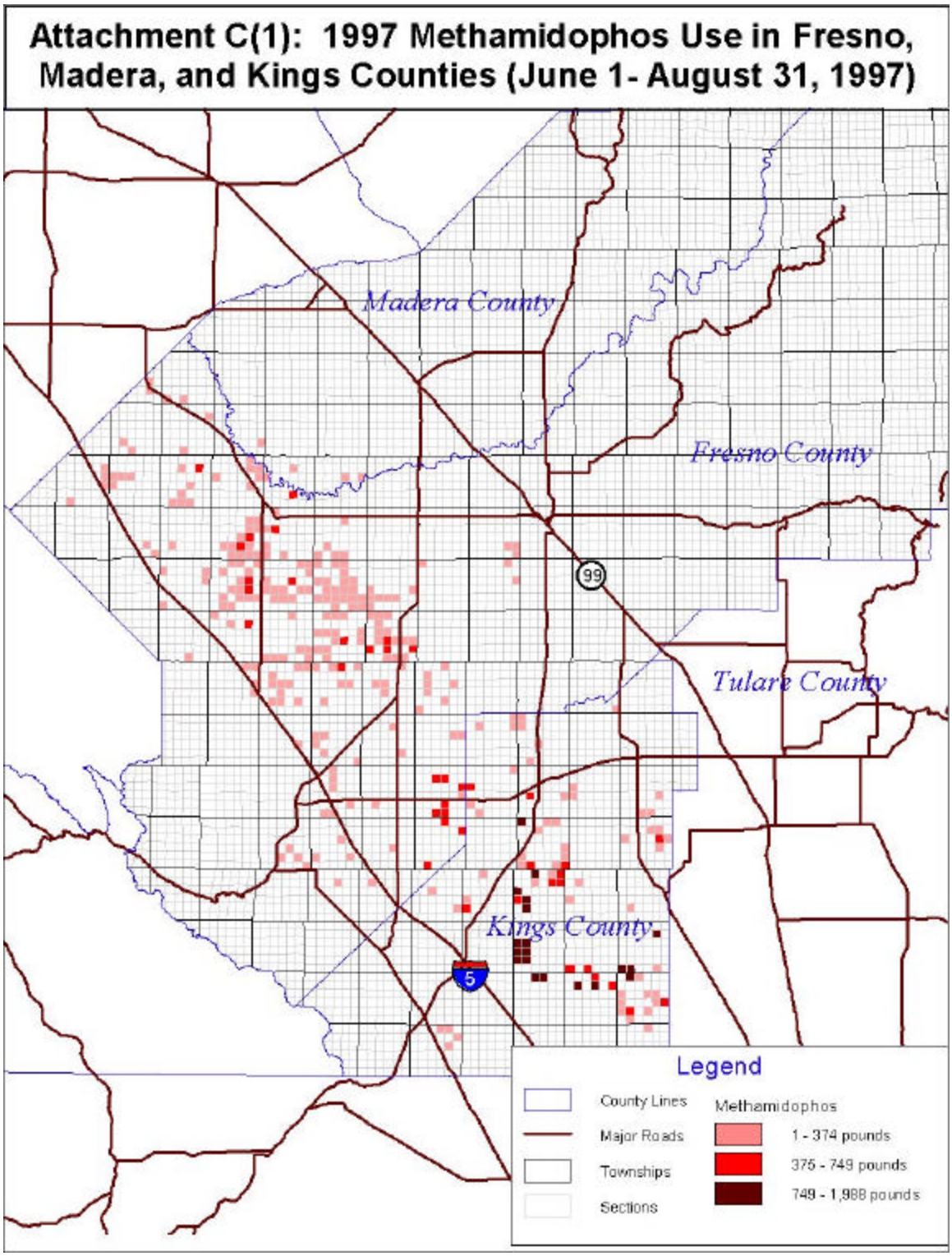

Attachment A(4): 2000 Acephate Use in Fresno, Madera, and Kings Counties (June 1 - August 31, 2000)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Acephate
1 - 299 pounds
300 - 599 pounds
600 - 898 pounds

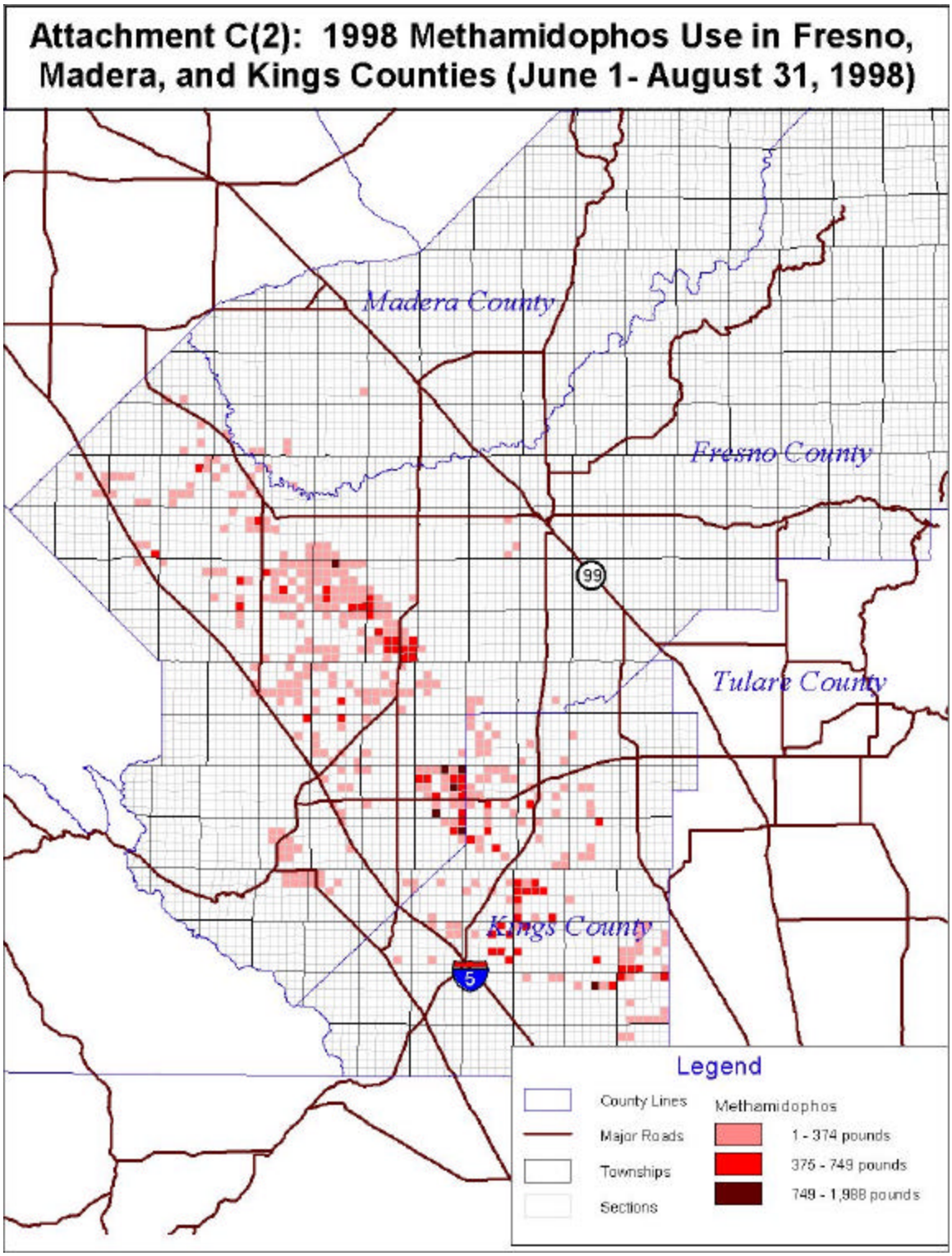

Attachment B(1): 1997 Chlorothalonil Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1997)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Chlorothalonil
1 - 799 pounds
800 - 1,599 pounds
1,600 - 2,335 pounds


Attachment B(2): 1998 Chlorothalonil Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1998)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Chlorothalonil
1 - 799 pounds
800 - 1,599 pounds
1,600 - 2,335 pounds


Attachment B(3): 1999 Chlorothalonil Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1999)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Chlorothalonil
1 - 799 pounds
800 - 1,599 pounds
1,600 - 2,335 pounds


Attachment B(4): 2000 Chlorothalonil Use in Fresno, Madera, and Kings Counties (June 1- August 31, 2000)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Chlorothalonil
1 - 799 pounds
800 - 1,599 pounds
1,600 - 2,335 pounds


Attachment C(1): 1997 Methamidophos Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1997)
Madera County
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Methamidophos
1 - 374 pounds
375 - 749 pounds
749 - 1,988 pounds


Attachment C(2): 1998 Methamidophos Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1998)
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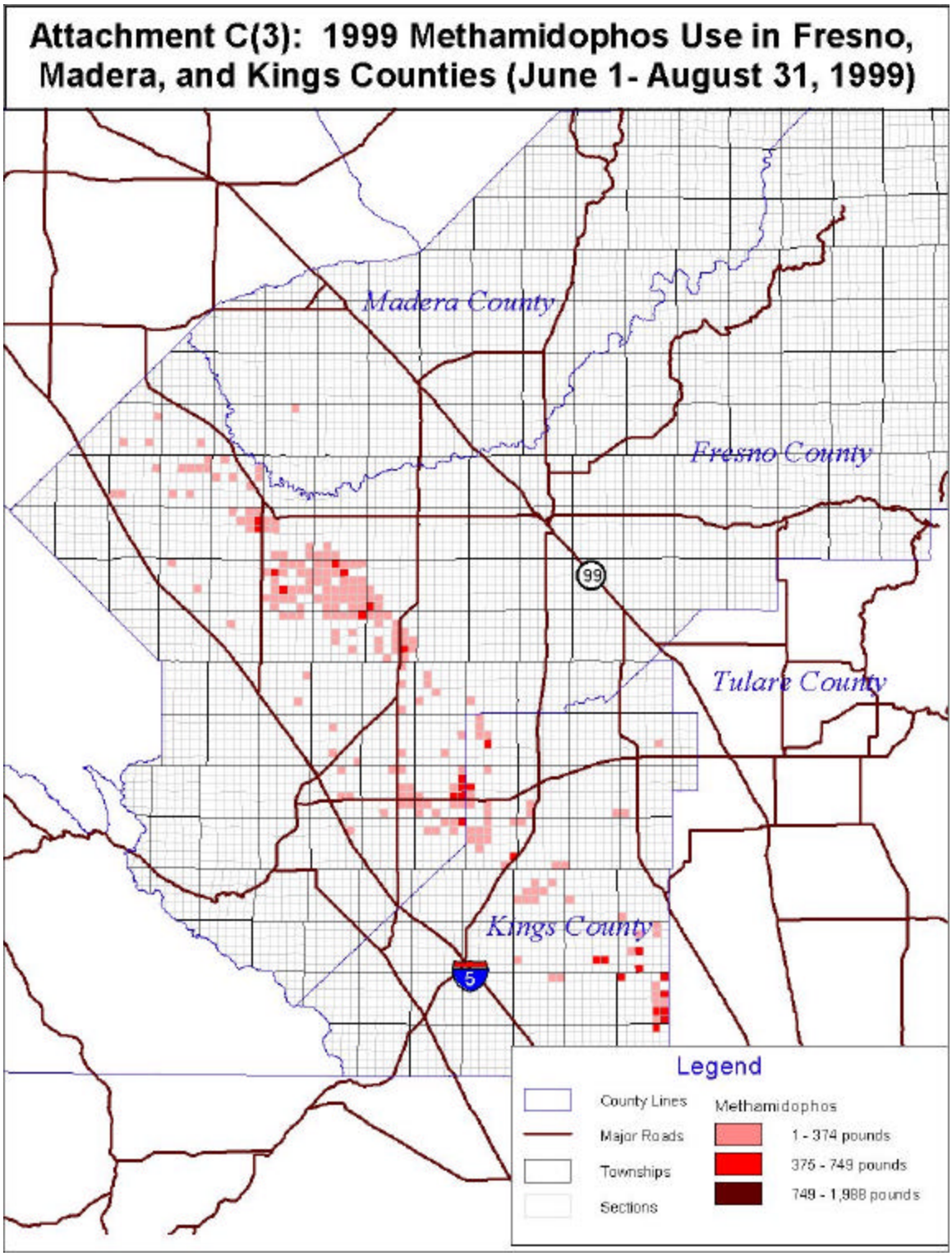
Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Methamidophos
1 - 374 pounds
375 - 749 pounds
749 - 1,988 pounds


Attachment C(3): 1999 Methamidophos Use in Fresno, Madera, and Kings Counties (June 1- August 31, 1999)
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Tulare County
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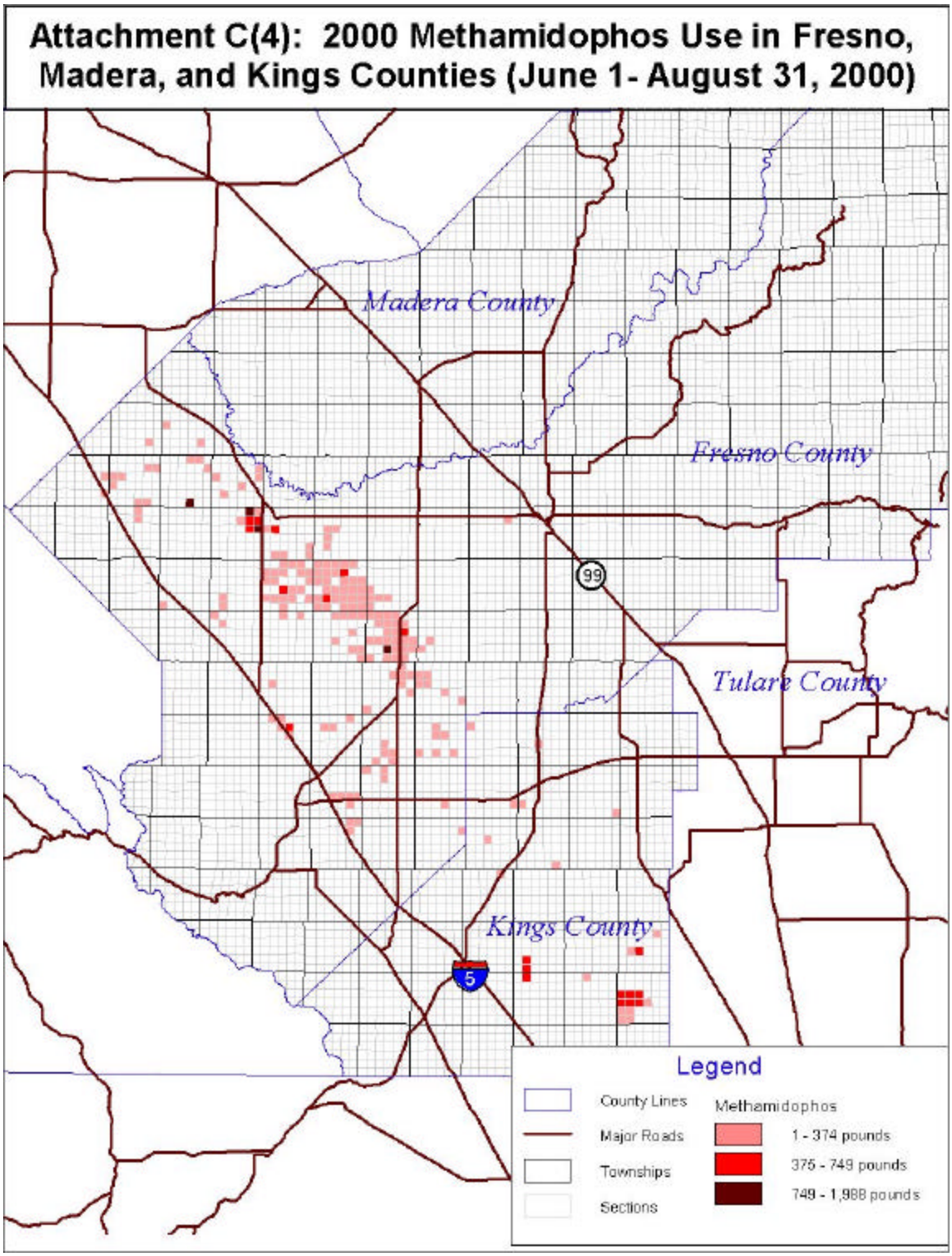
Legend
County Lines
Major Roads
Townships
Sections
Methamidophos
1 - 374 pounds
375 - 749 pounds
749 - 1,988 pounds


Attachment C(4): 2000 Methamidophos Use in Fresno, Madera, and Kings Counties (June 1- August 31, 2000)
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Fresno County
Tulare County
Kings County
99
5
Legend
County Lines
Major Roads
Townships
Sections
Methamidophos
1 - 374 pounds
375 - 749 pounds
749 - 1,988 pounds